

They had sufficiently established the general practicability of the attempt, and they had obtained an actual speed through the air of about 6 miles an hour, and it was easy to argue that by suitable provisions this might be increased to 10, 20, or perhaps even 30 miles an hour.

Meantime the French, who had no insular prejudices to restrain them, continued their experiments. M. Gaston Tissandier, an eminent man of science as well as a skilled *aéronaut*, conceived the possibility of applying electrical power for balloon propulsion; he exhibited a working model at the Paris Electrical Exhibition of 1881, and afterwards made, at his own expense, a large balloon, with which in 1883 he obtained a velocity of 9 miles an hour. But the French military authorities (wiser in their generation than ours) here stepped in, and, with their greater resources, carried the trials still further. They commissioned two of their engineer officers, Messrs. Renard and Krebs, to construct a balloon with which the problem might be thoroughly worked out, and the result is now given. The experiment has been a perfect success; an independent velocity through the air has been attained of upwards of 13 miles an hour; the balloon has been managed, steered, and guided with the greatest ease, and it has, in defiance of the wind, been made to return to its starting-point, the test proposed by Col. Burnaby.

But the most valuable part of the communication to the Academy of Sciences has been the investigation of the bearing of the experiments on the scientific conditions of the problem. There were two points especially which, from the want of actual experience, had in former calculations to be estimated by analogy from water navigation: the resistance which a balloon would encounter at different speeds in its passage through the air, and the efficiency of the screw propeller in overcoming this resistance.

First, as to the resistance. M. de Lôme estimated this by the midship section, but in a vessel much elongated the length has also to be taken into account. Prof. Rankine has given a rule for ships according to the wetted surface, and also another dependent on the displacement. Adapting these to air, and making certain additions which M. de Lôme estimated as special to the balloon, I obtained for the resistance in lbs., the diameter and length being in feet, and the velocity in feet per second—

$$\begin{aligned} \text{By the skin friction } R &= 0.0000477dlv^2; \\ \text{By the displacement } R &= 0.0000886(d^2l)^{\frac{1}{3}}v^2. \end{aligned}$$

Now, taking the proportion of MM. Renard and Krebs's balloon at $l = 6d$, these equations become—

$$\begin{aligned} R &= 0.000286d^2v^2, \\ \text{and } R &= 0.000292d^2v^2. \end{aligned}$$

The result of the latest French experiments is, when put in English measures—

$$R = 0.000320d^2v^2.$$

This is a little higher than the estimation by the former methods, but it corresponds sufficiently well to give confidence in the general mode of inquiry.

Secondly, as to the efficiency of the screw propeller. This has been often investigated for water navigation, and it may be said that an efficiency of 70 per cent. is fairly borne out by experience. MM. Renard and Krebs obtain for their screw an efficiency of only about 50 per cent.

It is, I should think, highly probable that by further experience both these elements may be considerably amended; but even taking the facts as they are, they show the attainment of considerably higher speeds to be perfectly practicable. A balloon of 50 feet diameter, for example, would carry power sufficient to give a speed of upwards of 20 miles an hour, and still leave a considerable buoyancy disposable.

At any rate, let us hope that we may have no more quasi-scientific declarations of the impossibility of propelling and guiding balloons, and no more sneers at those who attempt to solve the problem. The capabilities of aerial locomotion of this kind must (as I have fully shown elsewhere) be necessarily limited, but its utility in certain situations would be incontrovertible. The President of the Institution of Civil Engineers, Sir F. Bramwell, speaking in January 1885, said:—

"There may undoubtedly be particular circumstances in which this mode of locomotion would be useful, such, for example, as the exploration of new countries, or as the present Egyptian campaign. I strongly suspect that if our lively neighbours, instead of ourselves, had been invading the Soudan, they would long before this have had a dirigible balloon looking down into Khartoum."

And we have now a curious comment on his words, as we know that at that very time there was, lying in its shed near Paris, a balloon which, though perhaps it could not have saved Gordon, might certainly have saved poor Burnaby, and otherwise have been of incalculable benefit to our military operations.

WILLIAM POLE

MEDICAL STUDY IN OXFORD

STATUTES for the regulation of the qualifications of Candidates for Degrees in Medicine and Surgery, and for creating a Faculty of Medicine in the University of Oxford, have after prolonged discussions been approved by Congregation in their definitive form. The Statute which places the medical studies of the University under the control of the new Board of the Faculty of Medicine recently received the final sanction of Convocation, and the other statutes will soon follow. The interest which these Statutes have excited could certainly not be attributed to the radical nature of the changes which they will initiate. It must be rather due to the circumstance that the establishment of the new Faculty is regarded as an indication that Oxford, which has hitherto stood alone as the only University in the United Kingdom which has no medical students, and in which there is no organisation for medical instruction, now intends to undertake this function.

It is well known that the Oxford Medical Degree is one of the most coveted professional distinctions, but it does not, like that of Cambridge or Edinburgh, mean that the possessor of it has been trained either in science or in medicine at Oxford. In future there is reason to hope that it will be otherwise—that the University will no longer confine itself to the giving of degrees, but will teach all those branches of medical knowledge which come within the range of University studies.

Chemistry, human anatomy, and physiology, are the three subjects which constitute the scientific foundation of medical education, the last-mentioned being itself founded on the other two. For the instruction of medical students in human anatomy, the University has lately imported from Edinburgh an accomplished and experienced teacher, Dr. Arthur Thomson, who has already as many pupils as he can find room for; and the completion of the new laboratory has rendered possible the development of practical work in physiology. But the mere providing of the means of instruction in these subjects is insufficient, unless the lectures and laboratory work are so systematised as to enable the student to learn all that he needs to learn within the limited time at his disposal, and at the same time each branch of teaching is sufficiently specialised to adapt it to his requirements.

The bearing of the new statutes on medical education in the University can be best understood in relation to the course of scientific training which an intending student of medicine will, if they are passed, be able to follow. Hitherto the Oxford graduate who has obtained

honours in biology, has been in no better position as regards his medical curriculum than he would have been had he taken an ordinary pass degree. For the statute now in force, which we hope in a week or two will be replaced by a better, does not permit him to present himself for his medical examination in anatomy and physiology until two years after his degree. In future it will be possible for him to do this at the same time with his examination in the Honour School in the same subjects; the practical effect of the change being that two years will be saved, and that he will be enabled and encouraged as an *undergraduate* to study human anatomy and physiology in their relation to medicine.

In Oxford, as is well known, every man who intends to take a degree in Arts, which is a necessary precursor to that in Medicine, must have passed the examination in classics and mathematics, which is known as "Moderations," and inasmuch as he is not permitted to present himself for this examination until the fourth term after matriculation, it is obvious that he is practically precluded (supposing him to have Medicine in view) from beginning his scientific education until after this period. Consequently, of the four years which intervene between matriculation and his final examination in the Natural Science School, only three at most are at his disposal for the study of physics, chemistry, anatomy, and physiology.¹ Of these three years one at the very least is occupied in acquiring a sufficient knowledge of the four subjects to pass the very thorough and practical "Preliminary Examination." In the scanty remainder of time which is thus left to him he has to get through the most important part of his Oxford work. He has to acquire such proficiency in physiology as will enable him to obtain a class in the Natural Science School, in addition to a very detailed knowledge of human anatomy and a limited acquaintance with organic chemistry. Under present conditions this can only be accomplished by men of exceptional power of work. The rest find it to their advantage to defer their anatomy and chemistry for another year, and consequently are not in a position to enter on their hospital studies until five years after matriculation. As this is more time than men of moderate means can spare, our system cannot be considered satisfactory until the medical student is enabled to devote the four years of University residence entirely to scientific education. The occupation of the first year in studies which, however excellent in themselves, do not fit him for the hard work before him is a grievance of which he may justly claim to be relieved. As, however, the exemption of natural science students from Moderations has already in principle been accepted by Congregation, there can be little doubt that, in the course of a year or two, the desired change will be carried into effect.

The great success of the School of Medicine at Cambridge, although no doubt chiefly due to the ability and energy of the men who are at the head of it, affords evidence that the conditions under which medical education is there conducted, are in themselves well adapted to the requirements of students. It is therefore of interest to compare our own proposed arrangements with those of Cambridge. Assuming that, with the aid of the new Faculty of Medicine, we succeed in giving effect to the views above indicated, there will still be fundamental differences between the two schools.

The first of these is that whereas here every aspirant to the degree in Medicine must have first graduated in Arts, the Cambridge student becomes from the moment that he has passed the "Previous Examination" free to devote himself exclusively to medicine. This of course means that, whereas in Oxford at least four years must intervene between Matriculation and the first examination in medicine, in Cambridge the corresponding point is reached in

three years, or even in two,—a loss of time which is chiefly due to the circumstance already referred to, that the year which intervenes between Responsions and the First Public Examination, is by the Cambridge medical student devoted to physics, chemistry, and biology. It is not, however, in this way only that our Oxford system tends to lengthen the course of medical study. Our "Preliminaries," which are adapted to the requirements of an Honour School, are at Cambridge represented by a pass examination in the same subjects, specially intended for medical students, and therefore presumably easier. But it is a point of much more importance that our medical candidate is required, before he presents himself for any medical examination, to have obtained a class in one of the branches of biology. On general grounds there seems reason for thinking that this is disadvantageous, for it does a man harm to compel him to pass an honour examination for, if one may so express one's self, pass purposes. Of the two subjects open to him, the medical student naturally chooses physiology, not only because it is more closely related to medicine, but because he may hope, by obtaining a first or second class, to exempt himself from further examination. In that subject the schedules are framed for the purpose of affording first or second class candidates the opportunity of showing their knowledge. Consequently, in attempting to prepare for it, the medical student who studies physiology specially for the sake of its applications to medicine, acquires a knowledge of wider range than he requires, but of imperfect quality. The evil is a serious one, but happily not difficult to remedy—either by establishing a pass examination in physiology, or, more simply, by marking off in the schedules those subjects which are of less importance to the medical student than the rest.

Enough has been said to show that, however insignificant the position of medicine in Oxford may seem to be at present, it is not likely to remain so. One of the difficulties in the way of medical study here—the non-recognition by the licensing bodies of Oxford teaching—was removed a year ago. The other is the occupation of time, of which the student requires every moment for his preliminary training in physics, chemistry, and elementary biology, with studies which, excellent in themselves, are not conducive to his purpose. From the moment that we are relieved from this drawback, we shall have everything in our favour, and success or failure will depend on our own exertion. In the meantime, it is not too soon to proceed with the organisation of our system of studies, so that, when the opportunity is offered for efficient action, we may be prepared to take advantage of it.

J. B. S.

CHARLES WILLIAM PEACH

AT the ripe age of eighty-six this genial and enthusiastic naturalist has at last passed away. Never was there a more notable example of the irrepressible instinct of a true lover of nature. Born in Northamptonshire, he eventually joined the Coast-Guard service, and was stationed at various parts of the coast where smuggling went on apace and where his shrewdness and tact were often more than a match for the daring spirits who defied the revenue laws. But in the intervals of his duties he found time for close observation of the living things he met with along the shores and of the plants, insects, birds, and fishes he saw inland. Working in the pre-Darwinian days, when the adding of new species to the known list was one of the chief aims of natural history students, his zeal was early enlisted on behalf of the species-makers. Some twenty species and several genera of sponges were first made known by him as inhabitants of our seas. He considerably augmented our list of native hydrozoa and polyzoa. Among the naked-eyed medusæ, echinoderms, mollusks, and fishes he also materially increased our know-

¹ For more detailed information as to the course of study in Oxford see an article by the writer in the *Oxford Magazine* for January 27, 1886.